

WHAT IS CLAIMED IS:

1. A tilt servo control device of an information recording/reproducing apparatus for recording information on and reproducing information from an optical recording medium set into said apparatus, said apparatus comprising an optical system for leading a laser beam emitted from a light source to a recording surface of the optical recording medium and a laser beam reflected by the recording surface of the recording medium to a photo detector and a read signal generator for generating a read signal in accordance with an output signal of the photo detector, said device comprising:

a recording medium type determining device for determining a type of said optical recording medium;

a tilt drive signal generator for generating a tilt drive signal so as to reduce a tilt angle between a normal to the recording surface of said optical recording medium at a position of said laser beam irradiating said recording surface and an optical axis of said laser beam by a method for generating a tilt drive signal corresponding to the type determined by said recording medium type determining device;

a tilt angle adjuster for adjusting said tilt angle;  
and

a driver for driving said tilt angle adjuster in accordance with said tilt drive signal.

2. A tilt servo control device according to claim 1, wherein said tilt angle adjuster includes a liquid crystal panel having a plurality of regions arranged in said optical

system, and

said driver drives each of said plurality of regions of said liquid crystal panel in accordance with said tilt drive signal.

3. A tilt servo control device according to claim 1, wherein said recording medium type determining device determines which optical disk of at least a CD-ROM, a CD-R, a single-layered DVD-ROM, a double-layered DVD-ROM, a DVD-RW, a general purpose DVD-R, an authoring purpose DVD-R and a DVD-RAM is set as said optical recording medium into said apparatus at the time of recording information.

4. A tilt servo control device according to claim 1, wherein said recording medium type determining device determines which optical disk of a CD type disk including a CD-ROM and a CD-R, and a DVD type disk including a DVD-ROM, a DVD-RW, a DVD-R, and a DVD-RAM is set as said optical recording medium into said apparatus at the time of reproducing information.

5. A tilt servo control device according to claim 1, wherein said recording medium type determining device includes a continuous focus driver for driving an focus actuator for adjusting a focal position on said optical recording medium so as to move the focal position continuously at a constant speed;

a device for observing an S-characteristic produced in a focus error signal obtained from a focus error signal generating circuit during the drive operation of said

continuous focus driver; and

a first type determining device for determining a type of said optical recording medium in accordance with a time interval between appearances of the S-characteristic.

6. A tilt servo control device according to claim 5, wherein said first type determining device determines that said optical recording medium is a CD type disk including a CD-ROM and a CD-R when said time interval between appearances of said S-characteristic is larger than a time threshold value and determines that said optical recording medium is a DVD type disk including a DVD-ROM, a DVD-RW, a DVD-R and a DVD-RAM when said time interval between appearances of said S-characteristic is smaller than the time threshold value.

7. A tilt servo control device according to claim 5, wherein said recording medium type determining device further includes a second type determining device for determining a type of said optical recording medium in accordance with the amplitude of said S-characteristic.

8. A tilt servo control device according to claim 7, wherein said second type determining device determines that said optical recording medium is a first category disk including a single-layered DVD-ROM and a DVD-R when the amplitude of said S-characteristic is larger than an amplitude threshold value and determines that said optical recording medium is a second category disk including a double-layered DVD-ROM, a DVD-RW and a DVD-RAM when the amplitude of said S-characteristic is smaller than the

amplitude value.

9. A tilt servo control device according to claim 5, wherein said recording medium type determining device further includes a third type determining device for determining a type of said optical recording medium by detecting whether said read signal or a tracking error signal obtained from a tracking error signal generating circuit contains a groove wobble component signal or not.

10. A tilt servo control device according to claim 9, wherein said third recording medium type determining device determines that said optical recording medium is a DVD-R when the groove wobble component signal is contained and determines that said optical recording medium is a single-layered DVD-ROM when the groove wobble component signal is not contained.

11. A tilt servo control device according to claim 9, wherein said third recording medium type determining device determines that said optical recording medium is a DVD-RW or a DVD-RAM when the groove wobble component signal is contained and determines that said optical recording medium is a double-layered DVD-ROM when the groove wobble component signal is not contained.

12. A tilt servo control device according to claim 5, wherein said recording medium type determining device further includes a fourth type determining device for determining a type of said optical recording medium in accordance with the contents of land pre-pit information of said optical

recording medium obtained from said read signal.

13. A tilt servo control device according to claim 12, wherein said fourth recording medium type determining device determines that said optical recording medium is a general purpose DVD-R or an authoring purpose DVD-R in accordance with the contents of the land pre-pit information of said optical recording medium.

14. A tilt servo control device according to claim 5, wherein said recording medium type determining device further includes a fifth type determining device for determining a type of said optical recording medium in accordance with existence or non-existence of a land pre-pit on said optical recording medium.

15. A tilt servo control device according to claim 14, wherein said fifth recording medium type determining device determines that said optical recording medium is a DVD-RW when a land pre-pit exists and determines that said optical recording medium is a DVD-RAM when no land pre-pit exists.

16. A tilt servo control device according to claim 14, wherein said fifth recording medium type determining device determines that said optical recording medium is a DVD type disk other than a DVD-RAM when a land pre-pit exists and determines that said optical recording medium is a DVD-RAM when no land pre-pit exists.

17. A tilt servo control device according to claim 2, wherein said tilt drive signal generator includes:

a first tilt servo section having a push-pull component

generator for generating a push-pull component signal containing differential components of output signals of respective split portions of said photo detector, a first tilt error signal generator for generating a first tilt error signal representing the tilt angle based on said push-pull component signal and a generator for generating a signal representing a correction value for each of said plurality of regions in response to said first tilt error signal;

a second tilt servo section having a delay element for delaying said read signal by a predetermined time period, a second tilt error signal generator for generating a second tilt signal by subtracting said read signal from an output signal of said delay element and a generator for generating a signal representing the correction value for each of said plurality of regions in response to said second tilt error signal;

a third tilt servo section for generating a signal representing the correction value for each of said plurality of regions so as to maximize the level of said read signal;

a selector for selecting one tilt servo section of said first, second and third tilt servo sections in accordance with the type of the recording medium determined by said recording medium type determining device; and

a generator for generating said tilt drive signal in accordance with the correction value output from the one tilt servo section selected by said selector.

18. A tilt servo control device according to claim 17,

wherein said selector selects said first tilt servo section when said recording medium type determining device determines that said optical recording medium set into said apparatus at the time of recording information is a DVD-RW or a general purpose DVD-R, and selects said second tilt servo section when said recording medium type determining device determines that said optical recording medium set into said apparatus at the time of recording information is a DVD-RAM.

19. A tilt servo control device according to claim 17, wherein said selector selects said second tilt servo section when said recording medium type determining device determines that said optical recording medium set into said apparatus at the time of reproducing information is a DVD-RAM, and selects said third tilt servo section when said recording medium type determining device determines that said optical recording medium set into said apparatus at the time of reproducing information is a DVD type disk other than a DVD-RAM.

20. A tilt servo control device according to claim 1, wherein

the tilt adjusting operation of said tilt angle adjuster is stopped when said recording medium type determining device determines that said optical recording medium set into said apparatus at the time of recording or reproducing information is a CD type disk.

21. A tilt servo control device according to claim 17, wherein said predetermined time period corresponds to time taken when the irradiating position of the laser beam

moves a first header field and a second header field of a header section of a DVD-RAM.

22. A tilt servo control method of an information recording/reproducing apparatus for recording information on and reproducing information from an optical recording medium set into said apparatus, said apparatus comprising an optical system for leading a laser beam emitted from a light source to a recording surface of the optical recording medium and a laser beam reflected by the recording surface of the recording medium to a photo detector and a read signal generator for generating a read signal in accordance with an output signal of the photo detector, said method comprising the steps of:

determining a type of said optical recording medium;

generating a tilt drive signal so as to reduce a tilt angle between a normal to the recording surface of said optical recording medium at a position of said laser beam irradiating said recording surface and an optical axis of said laser beam by a method for generating a tilt drive signal corresponding to the recording medium type; and

driving a tilt angle adjuster for adjusting said tilt angle in accordance with said tilt drive signal.